Food Habits of the Grassland Wolf in Inner Mongolia of China

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Abstract In this paper, food habits of the wolf (*Canis lupus*) was determined in Inner Mongolia, using scat analysis Results indicated that ungulates were the staple food items (frequency 53.8%, relative biomass 85.2 %). In the scats, animals was 40.3% by the frequency of occurrence, and 75.7% by the relative biomass. Compared with the food habits of wolves in Heilongjiang Province, wolves showed a different pattern in prey selection in this region. In this study, we estimated the relative biomass of food items, and amount of each prey ingested by a wolf, based on a linear regression equation, $y=2.76+0.02x$ ($r=0.997$), which was obtained in the feeding trials. It is suggested that wolves are opportunistic predator. Some suggestions for wolf conservation and management were discussed.

Key words: Wolf, *Canis lupus*, Food habits, Prey selection

Introduction

The wolf (*Canis lupus*) belongs to Carnivora. The wolf distributed in Inner Mongolia is a Chinese subspecies (*Canis lupus chanco* Gray). The wolf has a great ecological adapting capacity. It is almost distributed over whole China.

In some areas, the wolf often does a harm to some domestic animals. To control wolf population, people always manage to kill the wolves. In some regions, those who kill the wolves are even rewarded. Thus, exact role of the wolf in the ecological system should be clarified for the proper management of wolf population.

Little information is available on the wolf in China. Gao Zhongxin (1975) reported the general ecology of the wolf in northeastern China. Luo Zhexun (1993) reported the recent situation, distribution and management of wolves. As yet, there is no specific study on the food habits of the wolves. In other countries, there are increasing studies on the wolf. These studies focused on the seasonal changes of foods (L. David Mech, 1966; Muric, 1944; Ludwign N. Carbyn 1983) and the effect of the population dynamics on the other prey species(Toddk, fuller, 1989; L/David Mech, et al. 1988; Ludwign N. Carbyn 1983; Machael E. Nelson et al. 1986; A. T. Bergerud, et al. 1983). The common methods in the studies of food habits are scat-analyses (Frequency of occurrence, Biomass of prey ingested) (Floyal et al. 1979; Toddk, Fuller, 1989; Bruce et al. 1984). In this study, the methods of biomass of prey ingested was first used to determine food habits of wolf in China.

Study Area

The study was conducted in Xinbaerbuyou Banner 115°—117°48` N, 47°39`—49°50` E, which is located in the south-east of Hu League. This region has a continental, arid climate with little rain and much wind. There are 35 species of mammals living in study area. They are mainly the small mammals, listed as follows :wolf (*Canis lupus*), cape hare (*Lepus capesis*), fox (*Vulpus corsacks*), red fox (*Vulpus vulpus*) etc. Also there are some domestic animals, such as the horses, cow, sheep etc.

Materials and Methods

Materials

1. The food remains were collected from the region near the cave of the wolf or in the cave.
2. Scats

Methods

Food marks-analysis Food marks were obtained by digging in the cane of the wolves, after locating a cave. We collected the food remains near the cave, which were identified and recorded immediately.

Scat-analysis Methods used in this study were based on the frequency of occurrence and the biomass of prey ingested. Frequency of occurrence was expressed as the number of occurrences of each kind of prey divided by the number of fecal samples. Biomass of prey ingested were calculated based on each prey type fecal sample and estimation of the dry weight of prey according to the regression equation, $y=2.76 + 0.02\ x$ (calculated below), x is the mean adult weight of a given prey type.

In the laboratory, feces were broken down in water, and small fragments were separated from large ones using a sieve with a mesh of 1 mm. Material trapped in the sieve was spread out thinly in water, and clumps of large fragments were identified by sampling. Each class of remains was separated out by hand, and was dried, and weighed (Artois et al, 1987). These dry weights were in turn converted to original fresh weights consumed, using conversion factors for each prey type derived from the feeding trials. Procedures of the feeding trials were as follows: (1). First, the wolf was fasted for two days and all feces were cleared out in the cage. (2). Before feeding, each prey was weighed. (3). All the live prey was fed to the wolf. (4). Scats were collected every day. (5). After each meal, the remains of prey would be weighed. (6). Before feeding the next prey, the wolf was further fasted for more than two days. Then, according to the live weight of prey fed and the dry weight of this prey in the scats, we could obtain a linear regression equation.

Results

Food marks-analysis

During 1987-1993 in Xinbaerhuyou Banner, totally, we got 104 food marks and remains, including cape hare, 16; north-east hare, 5; domestic sheep, 33; Mongolian gazelle, 34; cow, 6. In this region, the main foods of the wolf were large and medium ungulate.

Scat-analysis

Analysis of 52 feces indicated that the food items of the wolves included sheep, Mongolian gazelle, cow, hares, and rodents etc. The frequency of every type of prey was expressed as Fig 1.

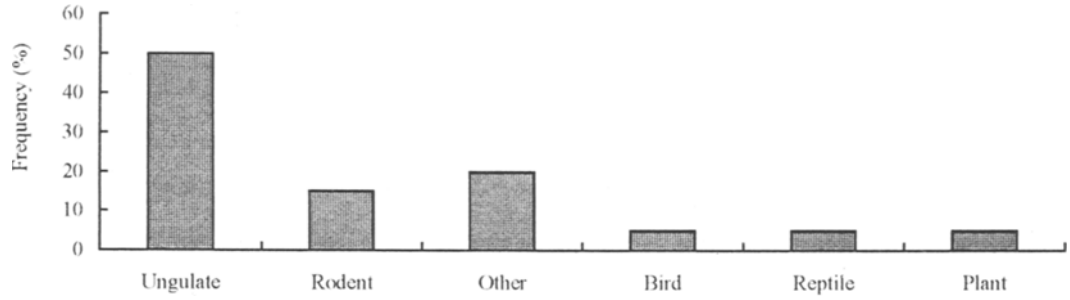

Fig. 1 Frequency of food items in wolf scats in the eastern Inner Mongolia

Table 1. The result of analysis

prey type	A	B	C	D	E
Sheep	36.5	46.3	0.3718	74.9	9.1
Mongolian sheep	13.5	28.5	0.1275	9.5	1.8
Cows	3.8	564.8	0.0368	0.77	0.08
Grass hares	13.5	2.51	0.1420	10.6	23.7
North-east hares	3.8	1.918	0.0238	0.5	1.46
Red foxes	1.9	5.45	0.0198	0.2	0.201
Voles	11.5	0.26	0.0431	2.73	58.9
Suslik	3.8	0.2671	0.0056	0.18	3.78
Marmots	3.8	3.93	0.0302	0.6	0.8

Note 1:A-Frequency of occurrence of the prey. B-The estimated mean weight of the prey. C-The dry weight of the prey in the counted feces. D-The relative biomass consumed. E-The relative number of individuals consumed.

Note 2: The numbers of B was provided by Mammal Fauna in Heilongjiang Province and Domestic animals in Heilongjiang.

Note 3: D = A × C / Σ (A × C)

Note 4: E = (D ÷ B) / Σ (D ÷ B) .

In 52 scats, most (92%) of them included one type of prey, others included 2-3 type of prey. In the Harbin Zoo, Changchun Zoo and Shengzhen Safari Park, we did feeding trials and got the linear regression equation, $y=2.76+0.02x$, where x is the weight of live prey, y is the dry weight of prey in the feces. Using this formula, we could get the results shown in Table 1.

Because carnivores generally discharged one feces every day (Shenghelin, 1993), we can calculate the amount of every prey killed by a wolf every year (F).

$$F = \frac{365}{Numbers\ of\ samples} \times \frac{G}{B}$$

where:

G: the live weight of prey ingested.

B: the mean weight of the live prey.

Every wolf killed about 3 sheep, 1.5 Mongolian gazelles, and 19 cape hares. These results were lower than actual cases, because the wolves had a surplus of killing.

Discussion

In this study region, the main foods of the wolves were ungulates (frequency of occurrence, 53.8%; the relative biomass, 85.1%). The wolves prey mainly on ungulates throughout the year (Mech, 1979).

The wolves in Heilongjiang Province mainly inhabited on the edge of the forest, farmland, and residential area. By using methods of scat-analysis, it is clear to see that the food items of the wolves are very complicated. However wolves prey mainly on large domestic animals, such as pig, horse and cow etc. (frequency of occurrence, pig, 41.75%; sheep, 22.7%). In comparison with the food habits of the wolves in Inner Mongolia, it is concluded that wolves in different regions live on different food sources (Gao Zhongxin, 1986; Murie, 1944). The main foods of wolves in North-central Minnesota was deer, the second was snowhare (Toddk, Fuller, 1989). In Yukon, wolves prey mainly on ungulates (Mooses) (frequency, 54%) (Hares, et al., 1991). In the other countries, the foods sources of wolves were not domestic animals. Wolves are opportunistic predators (Ludwign, Carbyn, 1988). Therefore, they may live in many regions.

Table 2 Food items of wolves in Heilongjiang Province

Food items	Frequency in Inner Mongolia	Frequency
Cow	9	11.3
Horse	10	12.6
Pig	33	41.7
Sheep	18	22.7
Red deer	4	0.5
Mooses	3	0.3
Roe deer	4	0.5
Hares	10	12.6
Chicken	2	2.5
Goose	1	1.3
Corn	5	6.3
Watermelon	2	2.5

The frequency of occurrence of rodents was a little high (19.1%). But we cannot conclude that they were more important than the other animals in the diets of wolves. When food resources were low, wolves also ate rodents and other mammals, even some plants. (Shenghelin, 1985). The relative biomass of rodents was very low (2.91%). Considering the energy cost, it wasn't economic for wolves to capture the rodents. Results from Table 1 may support this viewpoint. This also indicates that rodents were the emergent food source of the wolves. The frequency of occurrence of hares (16.3%) was second to rodents, but its relative biomass was much higher than that of rodents. Therefore, when we analyze the importance of all kinds of constitution of prey, the methods of frequency weren't ideal. Thus, it may be more reasonable to use the methods of biomass (J. D. Lockie, 1959; Laurence K. Corbett, 1989 etc.). Also, several related prey species may occur in the same fecal sample, so percent occurrence of a category of combined prey taxa in the total sample may exceed 100%. Therefore, how to interpret these data may be a very difficult problem.

In this study, we found that wolves did great harm to domestic animals (frequency, 36.5%; the relative biomass, 74.9%). Maybe wild preys of wolves in that region were seriously damaged. Thus wolves would prey mainly upon domestic animal. Hall (1971) thought the difference in the types of wolves wasn't related to the case in which they killed prey, but the availability of various prey.

Management and Suggestions

The present status of the wolf in China.

Wolves are well known by every one in China. There are many records and description about them in ancient Chinese books. Usually, the wolf is the major cause of damage to livestock. In the wild, wolves kill many ungulates and small animals. Sometimes it is reported that people are harmed and killed by wolves, but people know little about the function of the wolf in the ecological system. Therefore, in some regions, the government has called on people to kill the wolf, and people who did so were rewarded some money. Thus the wolf population decreased dramatically. The main reasons for the decline of the wolf population are as follows: (1). The natural habitat of wolves were changed into agricultural fields. Forest cutting and a large part of road building etc. have destroyed the basic habits of the wolf in China. (2). wolves were killed by people. (3). The evaluation on the function in the ecological system is not proper, usually overstating their harmful aspects.

Suggestion for the management of wolf populations

Measures should be undertaken to investigate the population of wolves as soon as possible, and according to the relationship between wolves and prey, we may control the amount of wolves.

Measures should be undertaken to prevent, reduce and control degradation of the natural environment by con-

ducting proper agricultural and forest practices.

Illegal hunting and poaching should be prohibited. Human direct interference should be decreased and avoided.

Little information is available about the wolf in China. More research is urgently needed.

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